PUBLICATION NO. 18

REPORT
ON
DISEASES OF FARM LIVESTOCK

SECTION VI

The Husbandry and Diseases of Goats

Issued by the
NATIONAL VETERINARY MEDICAL ASSOCIATION
OF
GREAT BRITAIN AND IRELAND

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January, 1950

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REPORT

ON

DISEASES OF FARM LIVESTOCK

SECTION VI

The Husbandry and Diseases of Goats

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Prepared by the

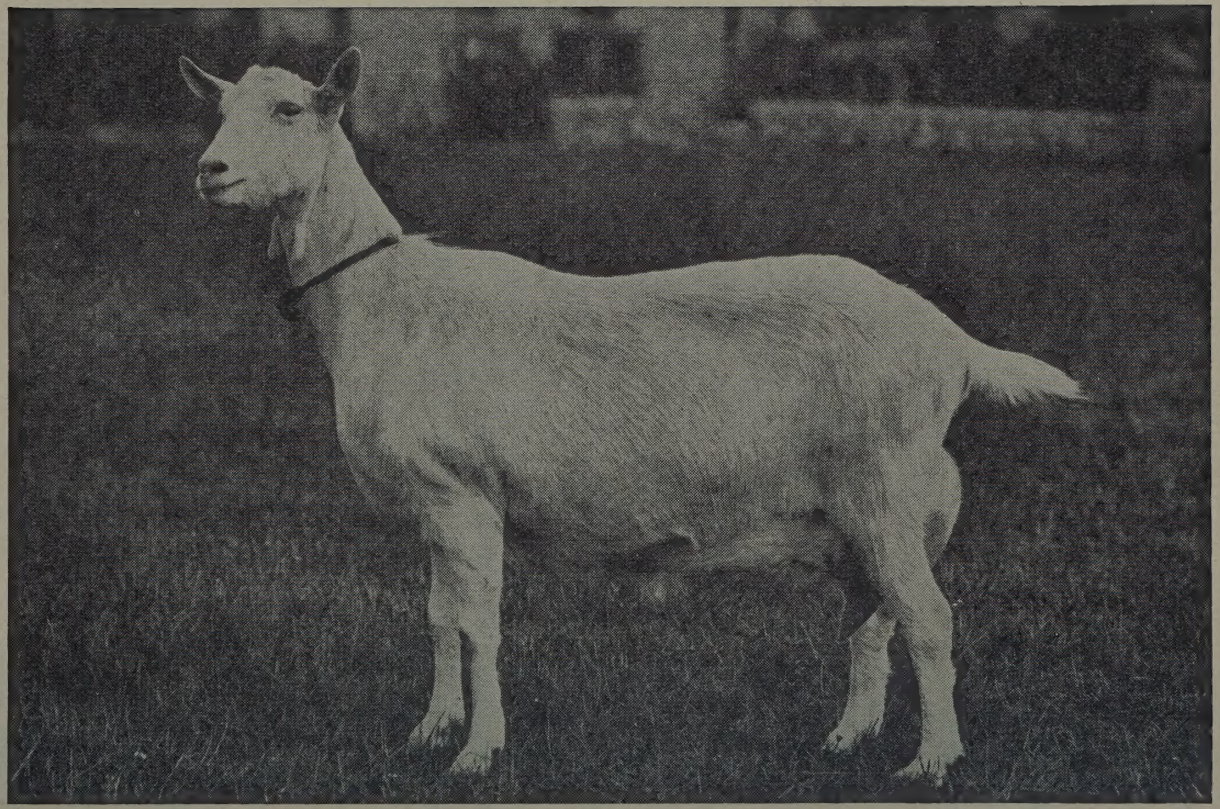
TECHNICAL DEVELOPMENT COMMITTEE

OF THE

NATIONAL VETERINARY MEDICAL ASSOCIATION

CONTENTS.

	Page
GENERAL INTRODUCTION	5
Stud Goat Scheme	5
Disbudding	6
GOAT HUSBANDRY:	
Outdoor Management	6
Housing	7
Feeding	8
REPRODUCTION	11
HYGIENE OF MILK PRODUCTION	13
DISEASES:	
Milk Fever	14
Acetonæmia	15
Pregnancy Toxæmia	15
Rickets and Osteodystrophia Fibrosa	15
Mastitis	18
Tuberculosis	20
Johne's Disease	20
Brucellosis	21
Goat Pox	21
Contagious Pustular Dermatitis	23
Entero-toxæmia	24
Other Diseases	26
MISCELLANEOUS CONDITIONS	26
DISEASES CAUSED BY INTERNAL PARASITES	27
Tapeworm infestation	29
Parasitic Gastro-enteritis	29
Parasitic Bronchitis	32
Liver-Fluke	35
Coccidiosis	37
Other Internal Parasites	41
DISEASES CAUSED BY EXTERNAL PARASITES:	
Lice	42
Sheep nostril fly	42
Sheep ked	43
Ticks	44
Mange mites	45
Harvest mite	48
TOXICOLOGY	48
ANÆSTHESIA	52



A Saanen Female

The Husbandry and Diseases of Goats

GENERAL INTRODUCTION

As a result of war-time milk rationing the number of goats, particularly those kept under ' cottager ' conditions (less than three goats per holding) has increased considerably in this country. The number of kids reared is limited by the sentimental attachment of many owners (which demands that they go to good homes only) and by the expense and labour of rearing. Small-holders find the latter difficult and uneconomic under the present rationing system, which makes no provision for goatlings needing concentrates during the five winter months when carrying their kids.

The existing stud goat scheme is organised by the British Goat Society in conjunction with the Ministry of Agriculture. A register of approved sires is published by the Society, the cost of the services of which is subsidised by the Ministry for the benefit of the ' cottager.'*

Recording of goats is recognised by National Milk Records and also by county clubs.

* In 1897, the officials of the British Goat Society devised a method for indicating good milkers at a glance. Any goat that reached a required minimum number of points in milking trials, held at a show under official supervision, was awarded a star, and this was placed after her name—thus Dainty Bess* ; and if her daughter in her turn also qualified, then another star was added to her name—thus Dainty Dora** ; and so on for each generation qualifying as a star milker in direct female line. The number of times a goat qualifies makes no difference, she can add only one star to her name. There are now two kinds of stars commonly known as ' plain ' stars and ' Q ' stars. The latter also are won on points, but to qualify the goat must give 4 per cent. butter fat, or over, at both morning and evening milkings. A similar system is applied to the males, the sign used being a dagger. This prefix is entirely hereditary : the male does nothing to earn the distinction. The dagger is placed before the name of any male goat whose dam and grand-dam on his paternal side have qualified as star or Q star milkers. From time to time the points in the milking trials, necessary to enable a goat to gain her star or Q star, are revised owing to the general improvement in milk yields, and it therefore becomes increasingly difficult for goats to gain their stars. Should the daughter of a star milker die before she qualifies and yet leave a daughter, this animal would have to begin at the beginning with one star only, the sequence having been broken ; and it is probably due to this fact that after 38 years only an eight-star milker has been reached.

GOAT TERMINOLOGY. In goat circles, the use of the terms 'billy' and 'nanny' are barred. 'The male' and 'the female' are used to denote adults; or, as an alternative, 'sire' or 'dam.' 'Goatling' refers to a female yearling; 'buckling' to a male yearling.

POINTS OF A GOAT. The show points of a goat are similar to those on which cattle are judged. In breed classes, females must conform to their breed types, but within these limits their suitability to produce milk is a governing factor. Broadly speaking, the goat should have a straight back, good girth and quarters, and be deep in the body, giving a wedge-shaped appearance. The udder should be square, well up under the body, with good-sized teats set well forward. Teats pointing outwards are not favoured on account of the tendency for animals of even average milking propensity to brush them with their back legs when walking or running, thus causing soreness or injuries. When empty the udder should be soft, smooth and pliable.

DISBUDDING.

The old method is the use of caustic potash, applying it to the horn bud until some 'beads' of hæmorrhage appear. Spread should be limited by the use of vaseline around the horn bud. After eight days, the use of caustic is not usually successful. In the heated iron or electric iron method, the operation can be carried out successfully until the kid is fourteen days old, or even later. The optimum time is at 5—7 days old. The older the kid the more prolonged must be the application of the hot iron. The hair is cut around the horn bud and the iron heated to 'cherry' red heat and applied for one period of ten seconds or two periods of five seconds, the area within the circle formed around the horn bud subsequently being burned down to the level of the ring by further application of the side of the iron. A local anæsthetic can be used by infiltration.

GOAT HUSBANDRY

OUTDOOR MANAGEMENT

TETHERING.

In the case of the 'cottager' or suburban goat-owner, good fenced grazing is not often available, but by tethering the animal out during the day-time in good weather, small unfenced areas of grazing or browsing—such as road verges or commonland—may be put to good use. The goat should be tethered by means of a chain attached at one end by a strong swivel and ring to the goat's leather collar, and at the other end to an iron post or to a wire running about one foot

from the ground between two posts. The tethering site should be changed frequently and an interval of several weeks' lapse before its use again, as a precaution against parasitic infestation. Goats will avoid strong winds, rain and hot sun when they can, and for this reason tethering should not be practised in such a way as to expose them unduly to these elements. Where facilities are available, a small hut about 4ft. 6in. square and placed on wheels so that it is easily movable may be used. It should have a doorway about one-third of the width of the front.

FENCING.

If a paddock is available, strong fencing is essential. Hedges will be eaten and broken down. Electric fencing is most useful, being cheap, light and easily moved to allow the resting of successive areas of pasture. Two, and more rarely, four strands of wire are used: where two strands are used, the lower one should be twelve inches from the ground and the upper one three feet; the lesser number of strands facilitates the moving of the fencing. Where four strands are used, the top one should be about four feet from the ground and the bottom one about nine to twelve inches. Only the top and the bottom-but-one strands need be electrified.

Chain fencing, chestnut palings or posts and rails are also used. Wire, even heavy sheep wire, has a tendency to be pulled down by goats continually standing on their hind legs and leaning their weight on the wire.

HOUSING

Whatever the system of management adopted—grazing, tethering or stall-feeding—it is necessary for warm, dry, well-ventilated housing to be provided at night and during the winter months.

Existing buildings, *e.g.*, sectional sheds, poultry houses, garages, stables, etc., can often be usefully adapted. A small concrete-floored yard provides excellent exercise space in bad weather when tethering out is inadvisable.

Loose boxes are most suitable for housing goats. They should be at least four feet square, preferably larger, and should be walled off to a height of four feet inside the house or solid to two feet six inches with rails six inches apart above.

Occasionally stalls are used. They should be about four feet by two to two and a half feet, divided by partitions four feet in front, sloping to two and a half feet behind. Provision should be made for a lidded hay rack two feet wide by eighteen inches deep and twelve inches across the top with rails two inches apart. The door should be fitted with an iron ring nine inches in diameter into which the food pail

can be inserted ; for preference, this should be on the outside of the door with facilities for the goat to put its head through the door to feed. Water pails similarly should be fixed to avoid damage by the goat ; a bracket for a mineral lick is often provided in addition. Fastening in stalls is usually by chain from the collar to a ring on an iron bar twelve inches long and secured to the wall by eye-bolts.

It is important to remember when constructing goat houses that the goat habitually stands on its hind legs, leaning its weight on the surrounding structures ; all fittings, therefore, should be nailed from inside to outside.

Lighting and Ventilation.

Outlet ventilation by louvre boards and raised tiles should be provided at the ridge if possible. Windows should be on the south side and of the inward-opening hopper type, with side guards against draught. Inlet ventilation may be by tobin tubes.

Flooring and Drainage.

Concrete, laid with air-spaces, is the most satisfactory flooring. There should be a slight slope to a gully behind the stalls two inches deep by four inches wide and sloping to an outside sump.

Bedding.

A raised slatted wooden bed may be provided, but generally is not satisfactory owing to the likelihood of injury to teats and feet. Slats are mounted one and a half inches apart on quartering about four inches in depth. If there is no wood flooring, wheat straw, peat moss or waste hay litter should be provided.

FEEDING

General Principles.

Successful management demands a full appreciation of the feeding habits and characteristics of the goat.

1. *Goats are browsing, not grazing animals* ; good pasture therefore, is not fully appreciated. For stall feeding, hay, branches, etc., are suspended at browsing height. Roots and concentrates are fed from a raised manger. Goats will not feed readily from the floor.

2. *They are fastidious but not selective feeders*, often refusing to drink from a receptacle used by another goat, yet readily eating poisonous plants. All food must be fed clean, *e.g.*, roots must be washed and cut up or they will be refused.

3. *Variation of diet* is essential as goats become easily surfeited. They tend to have marked likes and dislikes,

which vary with the individual goat. For winter feed, good quality meadow hay is preferable to seeds or clover hay and usually suffices with hedge clippings and succulents for the maintenance ration. Where the quality of the hay is low, it is usual to feed one to one and a half pounds of balanced production ration as an addition to the maintenance ration, or, as an alternative, the same amount of a mixture of flaked maize and crushed oats or other cereals.

Concentrates are fed to high-producing goats as a production ration. The usual difficulty is to induce the goat to consume an adequate amount to provide for its production.

The mixed balanced rations fed to cattle are satisfactory, fed at the rate of five ounces per pound of milk, or a proportion of the ration may be fed as compound dairy nuts. Good quality dried grass meal is useful and often readily eaten as meal or cubed. Some goat-keepers 'reconstitute' the meal by adding a little water.

Ensilage, particularly good quality grass ensilage, is often appreciated by goats, and is a good maintenance or production feed. The amount fed should be limited at the start and gradually increased to the required amount. Care should be taken not to introduce it too freely, as dietetic disturbance may result.

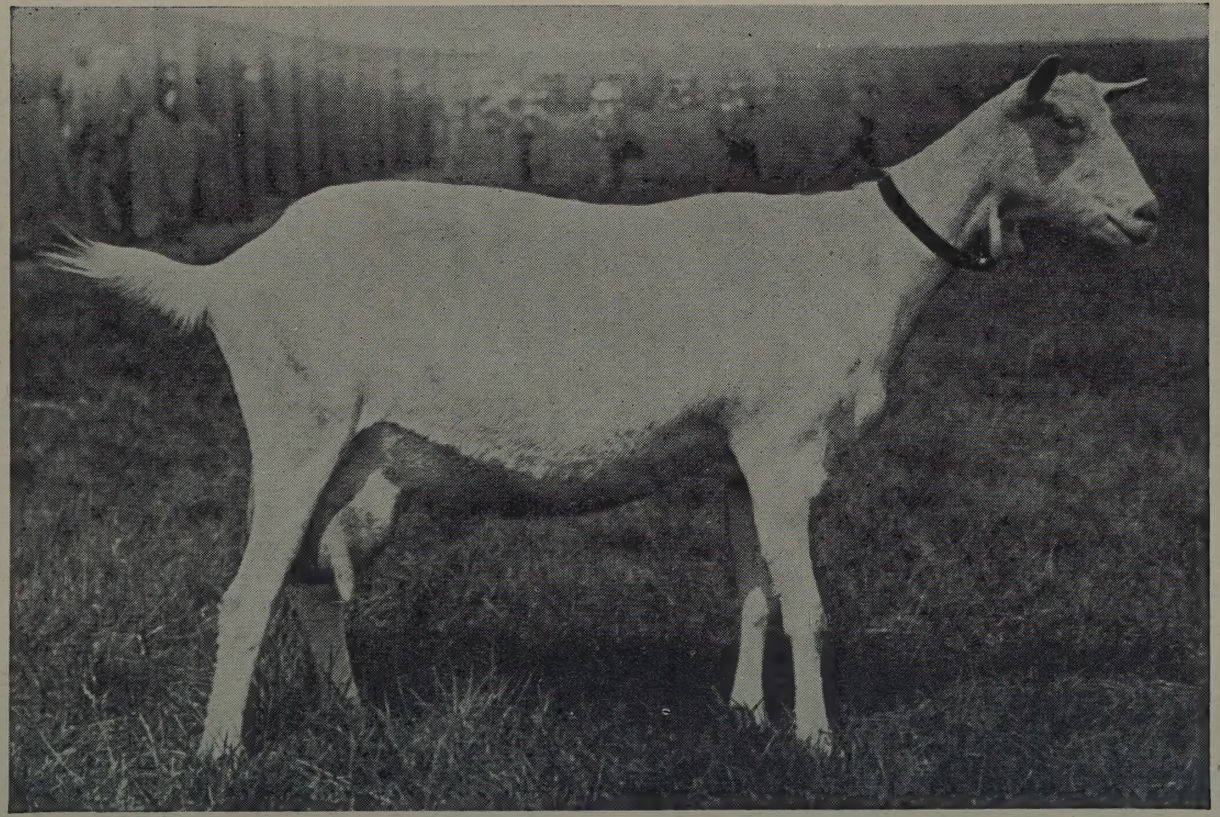
Ripe acorns, carefully dried before storing, can be used for feeding adults but should not exceed 10 per cent. of the production ration; they are usually fed crushed. Chestnuts, similarly, are sometimes fed shelled and crushed.

Household scraps, particularly bread, and vegetable and fruit peelings, are useful additional foodstuffs, often greatly appreciated. Swedes, mangolds, sugar beet and kohl rabi are nearly always acceptable; carrots sometimes, parsnips and turnips seldom. Potatoes should preferably be cooked.

It is very difficult to induce the average goat to take mineral supplements in its food, particularly in powder form. Minerals incorporated into compound cakes are, therefore, very useful. It is common practice for tablets containing calcium and/or phosphorus, in particular, to be administered to high-yielding goats. In housed animals, vitamin D is a very useful addition to the diet of young stock in the winter time. Salt licks and rock salt are usually acceptable, and may be of some benefit.

Since goats frequently refuse water left standing, it should be offered in a clean bucket at regular intervals—usually three times daily.

Dried milk and calf starter meals are used for the rearing of kids, with varied success, depending on management. The general principles to follow are those which apply to calf rearing.



British Saanen Female

REPRODUCTION

The goat, if well nourished, may reach sexual maturity at four to five months old. It is, however, generally considered inadvisable to breed the female kid until she has achieved her maximum growth (eighteen months). Male kids should be used occasionally from six months to ascertain fertility, but not regularly until eighteen months of age. The œstrus cycle of the goat does not normally continue throughout the year but lasts from September to March, thus the kids are usually born in the spring or early summer. Very occasionally, however, it may be continued throughout the greater part of the year. It is possible that a form of sub-œstrus, rather than œstrus, occurs in the quiescent period. The œstrous cycle is from nineteen to twenty-one days and œstrus normally lasts from two to three days. The gestation period is one hundred and forty-five to one hundred and fifty-three days (approximately five months). Oestrus is shown by restlessness, switching of tail, drop in milk yield, continuous calling, and swelling of the vulva ; the goat may also refuse its food. It may be very difficult to detect season in some animals, and in such cases they may be allowed to run with the male for a time.

The fertility rate of goats is generally high (probably owing to rational seasonal cycles), and the average number of kids born to each female is about 1·3.

Infertility. Information is very limited regarding the causes and treatment of infertility which, however, is not of such high incidence as in dairy cattle. Anœstrus is not uncommon and nutritional causes are probably of major importance. Some success has been claimed for stilbœstrol in the treatment of apparently anœstrus animals, both within and without the normal season, sometimes alone or in conjunction with either prolan or pregnant mares' serum. Only small doses of stilbœstrol diproprionate should be used —the maximum should be 1 mg., and this is best divided into 5 parts, and 1 part given daily for 5 days.

Nymphomania. This has been treated successfully by hormonal therapy (luteinising hormone)—antuitrin S, 2,500 units, or lutormone, 1,000 units.

Pregnancy Diagnosis. The diagnosis of pregnancy in the earlier stages is difficult or impossible. Urine tests are of no value. In the later stages of gestation, the fœtus may be palpated and the usual indications of approaching parturition become manifest.

'Cloudburst' is a condition of pseudopregnancy and is of fairly frequent occurrence. After a gestation period of

normal length, the female, appearing to be preparing for parturition, suddenly voids a large volume of cloudy fluid from the vagina and the previously existing abdominal distension disappears. The condition has been claimed to be associated with cystic ovaries, but there is little evidence to support this theory; the etiology of the condition remains obscure and its diagnosis difficult. After 'cloudburst' lactation proceeds fairly normally but the yield is rarely what one would expect after a normal parturition.

Infertility in males is of fairly common occurrence and may be associated with crypt-orchidism or hypoplasia of the testicles. Heredity appears to be important.

Hermaphrodism is common in the goat. Such animals usually have female characteristics when born, but a rudimentary penis can often be discerned within the lips of the vulva. Testicles may be palpated in the inguinal region and male habits and appearance are developed as the animal matures. There is evidence that hermaphrodism and hornlessness are very closely associated, "the dominant gene for hornlessness and the recessive gene for hermaphrodism being closely linked."

The fœtal membranes of goats are frequently retained without apparent harm, provided parturition has been achieved without the introduction of infection from without. Manual removal is not advisable. The use of constitutional treatment, where necessary, is usually adequate.

Endo-metritis is a common sequel to assistance rendered by the unskilled at parturition, and to attempts to remove fœtal membranes. Constitutional treatment is of great value.

Cæsarean section may be performed successfully on the goat. The technique is similar to that in the cow but multiple births may require an incision to be made in both horns of the uterus.

Prolapse of the vagina is not uncommon towards the end of pregnancy. Suturing of the lips of the vulva is a satisfactory method of treatment, the sutures being removed only when parturition is imminent. Raising the hindquarters of goats maintained in stalls, and the use of thin cord trusses are methods commonly adopted by breeders to counteract this condition.

Prolapse of the uterus may occur following pregnancy. Prognosis is unfavourable, shock being a marked feature of this condition. Epidural anæsthesia is extremely valuable in this disorder and elevation of the hindquarters is a useful

procedure when effecting return of the everted uterus. The condition is frequently associated with milk fever, for which calcium is usually specific.

Lactation. The relationship between the hormonal controls of lactation and parturition seems to be very much less rigid than in other species. Virgin milkers are common, lactation usually starting at about five months old. Once lactation is initiated it may continue for prolonged periods up to a year or more if the animal is not again bred. Lactation may be readily induced in the dry female by stilbœstrol implants —using specially hardened tablets, or by injections of stilbœstrol in oil.

HYGIENE OF MILK PRODUCTION

General Conditions.

The hygienic requirements are those laid down for the cowshed. Dusty bedding should be avoided and foods likely to taint the milk should not be kept in the house or fed immediately prior to milking. The male should on no account be kept in the same house because of the risk of taint.

A bench twelve to eighteen inches from the ground, two feet wide and three and a half to four feet long, on which the goat is trained to stand, is used to facilitate milking. The front legs may be prolonged up to two and a half feet with two bars between them, the top one being hinged to fit over the goat's neck ; or the goat may simply be chained to the wall in front.

Grooming, and cleansing of the udder prior to milking are on the same principles as those carried out in the cowshed. The use of a separate udder cloth for each goat is a desirable procedure. Milking should be as rapid as possible and stripping quick and thorough. The hot milking system can be used with advantage.

Cleansing and Sterilisation of Utensils, etc.

Milking stools, if used, should be scrubbed daily. Buckets should be seamless or an enamel jug may be used. This should be rinsed in cold or luke-warm water after milking, scoured with 2—4 per cent. soda water and scalded with boiling water. It is unlikely that sterilisers will be available. Milk should be strained through prepared filters or boiled muslin.

Rapid Cooling.

It is unlikely that a cooler will be available ; therefore the milk should be put in clean bottles or jugs and these should be placed immediately in running cold water.

Tainting in Milk.

Apart from the danger of taint from foodstuffs or the male, milk from some individuals may be strong-flavoured after kidding for a period up to fourteen days. Colostrum should not be used in any case for four days after kidding.

DISEASES

Most of the diseases of goats are common to other domestic ruminants. There are, however, a few conditions which require special mention or emphasis.

MILK FEVER

Acute post-parturient hypocalcæmia is of common occurrence in the milking goat. The high milking propensity of the goat and the tendency to low mineral intake, render it particularly susceptible to hypocalcæmic conditions. Milk fever frequently occurs during lactation at periods distant from pregnancy.

Symptoms and Diagnosis.

The disease usually progresses very rapidly and the animal is generally found recumbent and comatose. The earlier signs of inappetence, unsteady gait and progressive paralysis are often missed. The history of recent kidding is of great significance in diagnosis, but it should be borne in mind that an acute hypocalcæmia can occur at any time during lactation. The animal may remain in a state of coma or semi-coma for many hours if treatment is not applied. Response to treatment is dramatic but relapses after treatment are relatively common.

Treatment.

The goat responds well and often spectacularly to calcium therapy. One to two ozs. of calcium borogluconate in a 20—25 per cent. solution should be given intravenously, using the jugular or external saphenous vein. Borogluconate is often used subcutaneously and, not infrequently, it is associated with subsequent induration and/or sloughing at the site of injection, particularly if dispersal is not effected at the time of injection. If necessary the goat should be propped up on its sternum. If the response is unsatisfactory, the injection can be repeated or may be supplemented by an injection of phosphorus or, in cases of adequate partial response, by acid sodium phosphate given by the mouth in half-ounce doses. It is advisable to withhold milking for twenty-four hours, then to take gradually increasing amounts of milk from the udder over a period of a further two days. High quality concentrates and hay should be fed *ad lib.*

ACETONÆMIA

This occurs not uncommonly in the milking goat, particularly those giving higher yields. Glucose intravenously repeated daily, supplemented by glucose *per os*, is successful in some cases, but relapse is not uncommon. Liver extract, or vitamin B, given by injection, have proved of value in some cases. Recovery is not uncommonly associated with almost complete suppression of milk yield.

PREGNANCY TOXÆMIA

This is reported periodically amongst goats, mainly those kept under herd rather than 'cottager' conditions. Symptoms similar to those seen in ewes are observed. The condition would appear to be associated with hypoglycæmia and some cases respond well to intravenous injections of glucose, which may be supplemented by glucose *per os*.

RICKETS AND OSTEODYSTROPHIA FIBROSA

Sporadic lameness and bone deformity, which are not uncommon in goats, are due chiefly to a mineral imbalance. It is now generally accepted that in cattle and sheep, aphosphorosis results in rickets or in osteomalacia according to the age of the animal, and either may be associated with porosis. The position in goats is different. There is evidence to show that what has hitherto been described as rickets is an affection often complicated with osteodystrophia fibrosa. Both diseases can occur simultaneously and some workers assert that they are identical.

Bone diseases in goats are attributable mainly to calcium deficiency or imbalance and in many of their manifestations are not dissimilar from 'bran disease' in the horse. Phosphorus deficiency may also occur and, as in sheep, will produce rarefaction of bone. It would seem that the goat is even less able than the horse to regulate its serum calcium and inorganic phosphorus; this may be due to differences in the efficiency of the parathyroid mechanism, although no deficiency of parathyroid hormone has been demonstrated experimentally.

Diseases of the bones are invariably associated with unsuitable diets and are accentuated by lack of sunlight. They are not common in animals at grass, but in towns the rations are often unsuitable and liable to produce a serious calcium imbalance. A favourite diet—comprising oats, bran and minimum amounts of hay and green food—will produce symptoms of calcium deficiency, particularly in young goats, in a relatively short time. Spontaneous deficiency may show a seasonal variation which, for climatic and dietary reasons, reaches its peak in the spring. The symptoms are aggravated by pregnancy.

A Toggenburg Female

SYMPTOMS.

The early symptoms are indeterminate and are characterised by stiffness of the joints and lameness. The appetite is capricious and, as the disease advances, deformities of the bones—in particular those of the head, vertebral column and feet—may arise. Many cases, however, remain sub-clinical and, in the absence of a radiological examination, diagnosis may be difficult. Enlargement and distortion of the facial bones is particularly noticeable and gives rise to an appearance resembling ' big head ' in the horse. The deformity of the jaws interferes with prehension and rumination and death may supervene from starvation. The joints are also enlarged and hæmorrhagic. The picture, however, is not one of typical rickets, since the ribs do not show the irregularities characteristic of this disease, while the long bones are normal in shape, size and hardness. In acute cases, partial or complete posterior paresis may develop. Inability to stand is due in part to deformities of the feet. If the serum calcium reaches a sufficiently low level, symptoms of tetany may supervene and unless proper treatment is begun at once the animal will succumb rapidly.

POST-MORTEM FINDINGS.

At *post-mortem* examination the mandibles usually are soft and may be easily cut with a knife ; the bones of the limbs, although they may show a thinner compact layer, are not abnormally soft. Sections show that the medullated portion is composed largely of fine fibrous tissues, while the compact bone is replaced by very spongy tissue. The bone trabeculæ are small and sparsely distributed. Multiple hæmorrhagic foci are a prominent feature.

It is considered that the minimum requirement of the growing kid is 0.45g./Kg. of calcium per day. Under experimental conditions, a kid weighing 20 lbs. requires about 3.5—4.0 g. of lime per day, and the calcium/phosphorus ratio should be about 1 : 2. When the diet is adequate, the serum calcium should be in the region of 10.0 mg. Osteodystrophia fibrosa will arise if the amount of calcium drops to 2.4g. or less per day, especially if the calcium/phosphorus ratio falls to 1 to 1 : 2 or more. The serum calcium rapidly declines to levels of 5 mg. or less. It must be remembered that in the goat a lack of either calcium or phosphorus may produce rarefaction of bone from simple inanition, but osteodystrophia fibrosa will not arise unless the calcium is abnormally low in relation to the phosphorus.

Once the disease has reached an advanced stage a permanent cure cannot be expected. If, however, the bones are not severely affected a change of diet to one which is rich in

calcium will alleviate symptoms. To control tetany, calcium gluconate can be injected subcutaneously and a supplement of chalk administered in the ration. In addition, radiosteleum or cod liver oil will accelerate the process of repair.

Goats which are affected with osteoid diseases are not infrequently carrying a heavy parasitic burden which may accentuate the symptoms ; appropriate anthelminthic treatment may therefore be desirable.

MASTITIS

Despite the highly developed state of the udder in goats, mastitis is not often a cause of serious loss. Acute, sub-acute and, more often, chronic forms are met and sub-clinical or latent infections also occur.

As in other species, heat, pain and swelling are features of the acute cases, whilst the chronic cases show various degrees of induration or atrophy. Deep-seated, ball-like indurations—often high up in the gland, are not uncommon. Changes in the secretion vary from the presence of a few flakes or clots up to frankly altered secretion, but changes in the udder tissue without alteration of secretion appear more common in goats than in cows.

Injuries, bruising and chilling may give rise to acute or sub-acute symptoms but these are usually transient unless infection is already present or thereby becomes established. Contagious pustular dermatitis is also an important predisposing cause.

The bacteria found in a series of samples sent to one laboratory in England are shown in the table below. Few herd studies have been made in Great Britain, but one American worker states that of 619 goats in 27 herds, ten (1.6 per cent.) were infected with *Str. agalactiæ*, nine showing chronic mastitis whilst five (0.8 per cent.), all with mastitis, were infected with hæmolytic staphylococci. Ten goats had clinical symptoms but no bacteria considered of significance could be isolated. From the small amount of information available, it seems that mastitis unassociated with recognisable pathogens is more common in goats than in cows, and that, whilst latent infections occur, they appear to be less common.

The presence of *Staph. aureus*, a cause of acute mastitis in the goat, is important from the public health aspect, as food poisoning in humans has been reported from this cause.

For diagnostic purposes, udder palpation, the strip cup test, the chloride *p*H and cell content tests have all been used with very similar results to those obtained in cows. The following table is adapted from the results of the American worker mentioned above, and exemplifies this :

Comparison of Results of Various Tests, with Infection Data and Percentage of Normal and Abnormal Samples.

Test used	No infection detectable (604 goats)		Staphylococcus infection (5 goats)		Streptococcal infection (10 goats)	
	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal
Strip cup (flakes) ...	0.5	99.5	0.5	99.5	5.0	95.0
Chlorides : Over 0.16 ...	5.0	95.0	0.0	100.0	30.0	70.0
*p*H : „ 6.7 ...	5.0	95.0	40.0	60.0	30.0	70.0
Cells : „ 1,000,000	5.0	95.0	50.0	50.0	50.0	50.0
Palpation (induration, atrophy or hypertrophy)	8.0	92.0	80.0	20.0	93.0	7.0

(Reprinted by permission from British Goat Society's Year Book.)

With regard to cells, another American worker makes the point that cell-like structures often containing fat vacuoles, are frequent in goat's milk and are believed to be the broken off ends of secretory cells, this breaking off of parts of the cell being normal in goats. Goat's milk is normally of very low bacterial content, but infections with mastitis organisms may raise it considerably. Spread of infection can be controlled in the same way as in cattle, and especial care should be taken with known cases, clinical or latent.

Bacteria found in 109 Samples of Goats' Milk

Organism.	Character of Milk Sample.	
	Abnormal.	Normal.
Streptococcus dysgalactiae	2	2
Other streptococci	1	5
Hæmolytic staphylococci	8	9
Non-hæmolytic staphylococci... ...	6	11
Coliform bacteria	8	7
None found	12	38
Totals ...	37	72

(Reprinted by permission, from Dr. A. W. Stableforth's article in the British Goat Society's Year Book for 1949.)

TREATMENT.

Most of the therapeutic agents used in cows have also been used in goats, but it is advisable to avoid sulphanilamide on account of its high toxicity for the goat. Penicillin is the treatment of choice. 20,000 units per teat daily for two to five days is the dosage, according to whether the object is removal of clinical symptoms or sterilisation of any infection present.

TUBERCULOSIS

It is important to stress the fallacy of the popular belief that goats are naturally immune from tuberculosis. It is true that the species has a strong natural resistance and, under favourable conditions of housing and husbandry, the disease is uncommon. Nevertheless, it does occur and very occasionally as an enzootic. The goat is most commonly affected with the bovine type, and the infection is usually pulmonary. Cases of tuberculosis of the udder or generalised tuberculosis have rarely been reported in the goat. Tuberculosis should be suspected in cases of chronic respiratory disease.

JOHNE'S DISEASE

Johne's disease in goats was first reported about 30 years ago. It is now known that goats are highly susceptible to either natural or artificial infection; and the disease is not infrequently observed among well-bred animals confined to small paddocks. It is rarely observed among animals free to graze over a wide area. Recorded cases are claimed to be caused by *M. johnei*, bovine type; the degree of susceptibility to the ovine type has not yet been determined. Under natural circumstances the method of infection is apparently by ingestion.

PERIOD OF INCUBATION.

The period of incubation, based on experimental evidence, would appear to vary from one to two years.

SYMPTOMS.

The disease is a very fatal one. Probably when once an animal has developed marked symptoms it rarely, if ever, recovers. The first symptom noticed is a loss of condition, which is progressive. The animal has an unthrifty appearance, its coat is harsh and staring, and diarrhœa usually sets in. It may at first be intermittent to some degree, but becomes more and more pronounced and the animal loses condition rapidly. The animal retains its appetite almost to the last.

DIAGNOSIS.

Fæces examination may be examined for the presence of clumps of the characteristic acid-fast bacilli. An egg-count will readily differentiate the condition from parasitic infection.

LESIONS PRODUCED.

Apart from general emaciation and anæmia the lesions caused by the bacillus are confined to the intestine and associated glands, and even in these positions the lesions are of such a nature that they may easily be overlooked. It is usually the terminal portion of the small intestine that is most seriously affected. In a typical case the intestine is thickened and the mucous membrane has a coarse wrinkled appearance. In animals that have died or have been killed at an advanced stage there is usually no difficulty in finding the bacilli in scrapings from the intestines; but even in clinical cases there is occasionally a good deal of difficulty in finding the bacilli.

CONTROL.

Owing to lack of information on the predisposing causes of the disease, it is difficult to control it. A clean water supply, an adequate diet and the avoidance of overcrowding are important. Heavy liming of infected pastures and the feeding of mineral mixtures are claimed to be of value. Once the disease is diagnosed, the infected animal should be isolated and slaughtered. The bacillus may remain alive for at least twelve months on pastures. Where the incidence of the disease is high and measures of control have failed, vaccination can be carried out.

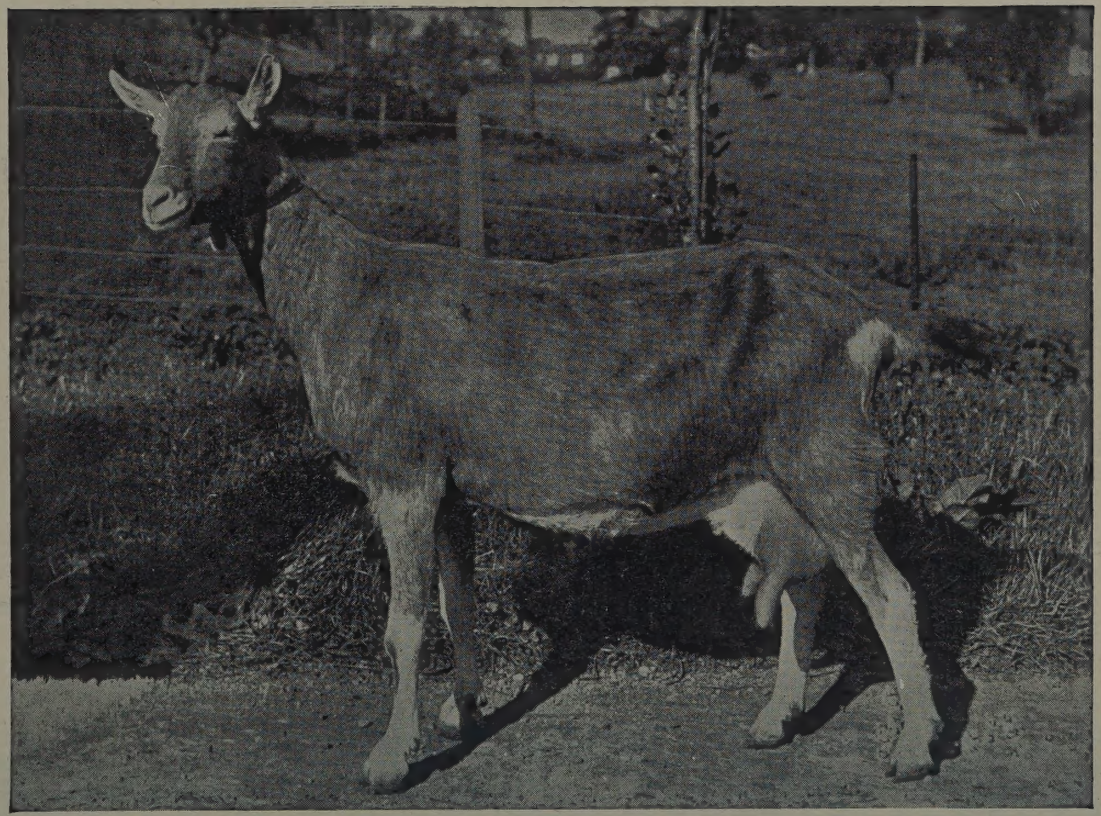
BRUCELLOSIS

There appears to be little evidence of *Br. abortus* infection and none of *Br. melitensis* infection in this country, but as goats are subject to these diseases in other countries every care should be exercised in dealing with suspected outbreaks. It should be borne in mind that it has been shown experimentally, that goats in this country are very susceptible to infection with both these organisms.

GOAT POX

(*Variola caprina*).

This condition affects the skin of the udder and teats but rarely other thin-skinned parts. The cause, as in other pox diseases, is a filtrable virus, and the incubation period is from one to seven days.



British Toggenburg Female

Goats of all ages are susceptible, but older goats are more commonly affected. Infection occurs from direct or indirect contact, the virus being present in the crusts covering the lesions. The course of the disease is about three weeks.

SYMPTOMS.

The disease is generally benign, but systemic disturbances such as anorexia, pyrexia and malaise may occur. Small reddened areas appear on the teats and udder; these become raised and pass through a papular stage before vesicle formation. A circle of inflammation occurs round the vesicle, which thickens and hardens, passes to the pustular stage, dries and falls off.

TREATMENT.

Affected animals should be separated and, if in milk, should be milked last. The milk is considered unsafe for several days before and after vesicle formation. Therapeutic treatments follow those recommended for dairy cattle.

CONTROL.

Thorough disinfection should be carried out during and after the outbreak, scabs and litter and other possibly infectious material being collected and burned. The aim should be to limit the spread of infection as far as possible and to prevent re-infection. When the outbreak has died down, final disinfection of all contact apparatus should be carried out, using hot water containing washing soda.

CONTAGIOUS PUSTULAR DERMATITIS

This disease is best known in sheep, and is characterised by ulceration around the lips and feet. It is relatively rare amongst goats in this country, but when it occurs it may be troublesome.

In goats the symptoms are essentially the same as those observed in sheep, but the lesions tend to be more localised. They are pox-like in appearance and soon progress to the ulcerative stage when healing may be delayed. The disease is caused by a virus, and spreads by contact, so that affected goats should be isolated. There is no specific treatment and the object of therapy should be to prevent secondary infection with such organisms as *Fusiformis necrophorus* and staphylococci.

Contagious pustular dermatitis is transmissible to man, and attendants should be warned to take precautions after handling infected stock.

ENTERO-TOXÆMIA

A fatal toxæmia in goats, due to the absorption of toxin produced in the bowl by *Cl. welchii*, type D., has assumed considerable importance in the field of goat husbandry during the last ten years.

The disease, which appears to be most prevalent in the late spring and summer, invariably attacks the best-conditioned animals in the herd. In this respect it resembles pulpy kidney disease in fattening lambs and entero-toxæmia in sheep, two diseases which are also attributed to *Cl. welchii*, type D. This anærobe is ubiquitous in soil, and in many grazing animals it is present as a harmless member of the bacterial flora of the intestinal contents. Under certain conditions of intestinal digestion, however, the organism is capable of rapid multiplication with the accompanying production of a potent toxin, the absorption of which leads to illness and often death. The exact conditions which lead up to this sudden rapid growth of an organism, normally harmless, are not well understood. It would certainly appear to be associated with ' flushes ' of grass or feeding green crops, since entero-toxæmia deaths commonly coincide with such conditions and in animals obviously well nourished.

The disease may attack goats of all ages, but is more common in those over six months old. Two forms of the disease are recognised, namely : an acute form which invariably terminates fatally within thirty-six hours, and a sub-acute or chronic form which is characterised by bouts of diarrhœa and marked depression, and usually lasts for seven to ten days. Animals affected with the sub-acute form often recover after a short convalescence.

The onset of the acute form in milking goats is usually marked by a sudden drop in the milk yield, loss of appetite, and early appearance of severe diarrhœa, sometimes blood-stained. The diarrhœa is often accompanied by persistent straining. There is evidence of abdominal pain. Death usually supervenes within thirty-six hours of the onset of the diarrhœa, and is usually accompanied by convulsive struggling.

Post-mortem Examination.

Post-mortem examination of goats which have died from the acute form of the disease invariably shows some degree of inflammation of the small intestine—the ileum apparently being the predilection site for multiplication of, and toxin production by, the organism. Evidence of the absorption

of the potent toxin of *Cl. welchii*, type D, is found in the varying degrees of epicardial, sub-endocardial, and sub-serous hæmorrhages throughout the abdominal cavity. Evidence of kidney damage may be seen in rapid decomposition of these organs after death.

Diagnosis.

Laboratory diagnosis depends on the determination of the presence of *Cl. welchii*, type D, and its potent toxin ε, in the intestinal contents. (For the purpose of diagnosis the laboratory requires the terminal few feet of small intestine tied off at each end to retain the contents.) It is essential that intestines should be removed and forwarded as soon as possible after death. Putrefactive changes may make identification of toxin impracticable.

Treatment and Prophylaxis.

In acute cases, death usually takes place before serum can be given. Where the cases are seen in the earliest stages of the disease, the injection of large doses of type D antiserum, up to 100 cc., may result in spectacular recovery.

Where the disease has appeared in a herd, all the in-contacts should be given 20 cc. of serum, and vaccination commenced. The vaccine which has proved most successful is a formalised whole culture vaccine prepared from *Cl. welchii*, type D, usually sold as pulpy kidney vaccine. It has been found that goats do not respond to vaccination as readily as sheep and in order to create a good level of basal immunity it is necessary to give two doses of the vaccine, the second after an interval of twenty-eight-days. Subsequently, to maintain this level of protection, it is necessary to re-vaccinate at three- to four-monthly intervals.

In addition to the above, some protection may be obtained by avoiding sudden changes in animal husbandry, *e.g.*, introduction of fresh succulent green food into the diet should be made gradually. *It must be added, however, that the all-white Saanan breed appears to have an idiosyncrasy where injections of pulpy kidney sera and vaccines—and, possibly, other vaccines—are concerned. Collapse, abortion and death have occurred with doses as low as 5 ccs. and as high as 20 ccs.*

Dosing with sulphamezathine has proved very effective. Dosage is as follows :

> 0.2 gms. per kilo body-weight followed by half the initial dose every twelve hours.

OTHER DISEASES.

Anthrax. Foot-and-Mouth disease.	These are scheduled diseases and both have been reported in Great Britain in recent years.
Tetanus.	Has also been reported in Great Britain both in kids, following disbudding, and in adult stock.
Actinomycosis. Botulism. Rabies.	These conditions have been reported in the United States.

Before proceeding to the subject of parasitic diseases, the following may be listed here.

MISCELLANEOUS CONDITIONS

Lameness due to overgrown feet is very common. The goat, being normally a hill and mountain animal, has rapidly-growing hooves ; in consequence, when kept on soft ground wear is limited and the walls often become overgrown and turn under the sole, sometimes causing lameness. The horn is comparatively soft and is easily pared with a sharp hoof- or pocket-knife.

Sand crack is not uncommon and is treated by routine methods.

Laminitis is a disease well recognised by goat-keepers.

Swelling of the tongue. A painful swelling of the tongue may be caused as the result of ingestion of Cuckoo Pint.

Retention of Urine in the Male. The male goat, like the ram, is liable to urethral obstruction, leading to the retention of urine. Feeding on mangolds is considered inadvisable on account of its association with this condition.

Hardening of the Skin in the Male. There is a tendency for the skin of the male goat to become hard and horny after the age of five years or so. Washing the affected parts with an alkaline solution such as soda, and the subsequent use of an emollient preparation, is practised by many owners with apparent success.

DISEASES CAUSED BY INTERNAL PARASITES

Goats may be parasitised by any of the parasitic helminths that occur in sheep and where the goats are confined to small paddocks, or are tethered on restricted pasture, they are very prone to suffer from parasitic gastro-enteritis, from parasitic bronchitis and from other nematode infestations. When given greater freedom, however, they are much less likely to suffer from nematode diseases on account of their preference for browsing. For similar reasons they are very unlikely to suffer from fascioliasis although their susceptibility is as great as is that of sheep. Anthelmintic treatment, in general, is not tolerated so well by goats as it is by sheep, and it is advisable to prescribe with caution, reducing the dose to three-quarters of that recommended for sheep.

ADULT TAPEWORMS

The two species of the genus *Moniezia* that occur in sheep are also found in goats. Infestation is particularly common during the first six months of life but is not accompanied by symptoms other than a general unthriftiness. In unusually heavy infestations an impaction of the small intestine may be brought about. The life cycle involves an intermediate host, a free-living mite which in this country is usually of the species *Scutovertex minutus*. This mite, which is particularly small, is of very common occurrence in old pastures. The infective cysticercoid develops in the mite and is ingested while the goat is grazing. Copper and nicotine sulphate treatment is moderately effective, but the dose should be only one half to three-quarters of that used in sheep.

The solution is made up as follows :

Copper sulphate crystals	1 lb. 4 ozs.
Nicotine sulphate (40% solution)	1 pint
Soft water	$2\frac{1}{2}$ gallons
Hydrochloric acid	10-12 drops

and the recommended doses for goats are :

Adults	4-6 drams
Goatlings of 6-9 months	3-4 drams
Goatlings of 3-6 months	2-3 drams
Goatlings of 2-3 months	1-2 drams

Anglo-Nubian Female

TAPEWORM CYSTS

Goats may be infested with the larval stages of four species of cestode—those of *T. hydatigena, T. ovis, T. multiceps* and *Echinococcus granulosus. T. multiceps* is of importance because of its association with gid. Surgical removal of the cyst is the only hope of successful treatment. The importance of *E. granulosus* lies in its danger to man, dogs becoming infected with the adult form through devouring lungs and livers that contain the cysts; the eggs which later appear in the fæces of the dog are capable of giving rise to a fatal infestation of man with hydatid cyst.

CONTROL.

This lies in the prevention of ingestion by the goat of food contaminated with droppings from infected dogs. To this end, routine treatment of dogs should be undertaken.

PARASITIC GASTRO-ENTERITIS.

This term refers to an acute or chronic disease of the fourth stomach and small intestine, caused by the presence of a massive infestation of one or several species of small parasitic nematodes belonging to the sub-family *Trichostrongylinæ*. The nature of the disease varies only slightly with the species of parasite concerned so that the various specific infestations may very properly be dealt with as one disease.

In general the species of worms found in the fourth stomach are more pathogenic than those found in the small intestine, the three most important being *Hæmonchus contortus, Ostertagia circumcincta* and *Trichostrongylus axei. Trichostrongylus vitrinus* is thought to be the most pathogenic of the species that are found in the small intestine. *Nematodirus filicollis,* and the several species of *Cooperia* that frequently occur in large numbers, are generally regarded as of slight pathological significance.

H. contortus is a voracious blood-sucker and causes an anæmia comparable with that which may be brought about experimentally by repeated severe daily bleedings. The several other species of worms do not suck blood in appreciable amount nor, except on rare occasions, do they cause any serious local inflammatory reaction. Nevertheless, the presence of a large number of these parasites, especially in the small intestine, may act as an intestinal irritant and thus interfere with the process of digestion. It has been postulated

that the pathogenic action of the parasites is in some obscure way connected with their production of an injurious toxic substance, or possibly that they give rise to anti-enzymes that interfere with the digestive processes of the host.

The most constant symptom of parasitic gastro-enteritis is a progressive loss of condition ; but this symptom is often overlooked when the disease occurs in animals subsisting on a poor diet. In the more severely affected animals the loss of condition frequently proceeds until a state of emaciation is reached. Diarrhœa generally becomes a noticeable symptom shown by some or almost all of the animals in a herd ; but diarrhœa is not a constant symptom and, in some animals, severe infestations are accompanied by constipation. Appetite remains good until a very late stage. As the disease progresses, weakness becomes very marked. The visible mucous membranes may appear anæmic and in severe hæmonchus infestations this symptom may be most pronounced. In exceptionally severe outbreaks of hæmonchosis, death may occur before loss of flesh is noticeable, but affected animals invariably show evidence of acute anæmia.

Symptoms.

Symptoms usually develop in a large proportion of the herd at about the same time. The occurrence of individual cases of parasitic gastritis is very rare. Kids are the most susceptible. Healthy adults are relatively resistant.

Post-mortem Examination.

At *post-mortem* examination, poverty of the carcase, especially when accompanied by evidence that the animal had suffered from diarrhœa, should immediately arouse a strong suspicion of parasitic gastro-enteritis. In many cases the abdominal fat has disappeared or is very scanty, but when the animal has died from a recently acquired very severe infestation, particularly with *H. contortus,* a considerable accumulation of abdominal fat may still be found. In hæmonchus infestation, the mucous membrane of the abomasum may be inflamed, and a considerable quantity of blood may sometimes be found in that organ ; small ulcers and punctiform hæmorrhages may be present in the mucous membrane of the abomasum which may occasionally be found covered by a thick mucus. With the other species of parasites the inflammatory changes in the abomasum are less evident and generally are entirely absent. The intestine does not show any definite lesions. The other organs are usually paler in colour than normal and the blood frequently appears thin and watery.

The epizootiology presents several characteristic features dependent upon the life history of the parasitic worms. In their essential points these life histories are the same for all of the species concerned. The eggs, which are laid in large numbers by the adult worms, are all passed on to the ground along with the fæces of the infected animals. There they give rise to larval forms which, under optimum conditions, are able to reach a state of readiness for parasitic life within four or five days ; the larvæ then leave the fæces in which their early development has taken place and migrate into the herbage where they await the grazing host.

The health of the goat is not adversely affected until a relatively heavy infestation occurs. The three requisites for larval development are moisture, warmth and oxygen. Moisture is essential for the development of the larvæ and for their longevity on the pasture. Therefore, provided the temperature is suitable, wet and humid weather conditions and long herbage favour larval development, whereas drought and short herbage are unsuitable.

The veterinarian frequently is consulted concerning the period of survival of infection in the pasture herbage, and the minimum interval after which it may be safe to readmit animals to a pasture known to have been heavily contaminated. Although infective larvæ are known to be able to survive for upwards of 12 months in pasture herbage, it is only those few that happen to be situated in a permanently moist and protected environment, deep in the grass tufts or between the leaf sheath and the shoot of the grasses, that are able to do so. The remainder of the larvæ have much shorter lives, depending upon the exposure of their position in the herbage, and those on the most exposed parts do not live for more than a few days. After even heavy contamination, it is only necessary to allow the ground a sufficient rest to ensure the reduction of larval concentration to normal proportions. A period of about six weeks generally will be sufficient for this purpose.

A most important point concerning the epizootiology of this disease is the relative susceptibility of young animals and the development of immunity in the young stock as they mature ; these factors apparently operate towards the development of a resistance that begins in early life, possibly at about the age of four months, and slowly develops until about the age of ten to twelve months, when it may be regarded as having reached its maximum. This resistance or immunity is, however, far from absolute and may be broken down as a result of inadequate or deficient nutrition, such as obtains during times of drought or when the pastures are poor. The resistance may also break down under the strain of lactation.

DIAGNOSIS.

The diagnosis of the disease depends firstly upon the appearance of the symptoms in several members of a group of goats ; secondly, upon the history of the outbreak which will involve the points already discussed in connection with epizoötiology ; and thirdly, upon the confirmatory evidence of fæcal egg counts and, better still, the *post-mortem* examination of one or more members of the affected group.

When the veterinarian wishes to send material to a laboratory to be examined for worms, the fourth stomach complete with contents, and the first twenty to thirty feet of the small intestine, ligatured at both ends to retain its contents, may be despatched in a tightly sealed container.

Fæcal samples constitute the only other material that need be despatched to the laboratory and they should be sent well pressed down in a small bottle so as to exclude air ; this will greatly retard the development of the eggs so that little or no hatching will occur before such time as the examination can be carried out.

PREVENTION.

This depends largely upon the adequate nutrition of the animals, the avoidance of too restricted browsing and the cautious use of anthelmintics. The application of substances such as lime, kainit, or copper sulphate to the herbage of infested pastures is of little or no use for the destruction of larvæ, but a considerable reduction in the infestation of the pastures may be brought about through grazing them with animals that are not suitable hosts for these worms. Horses serve this purpose best but are rarely available in sufficient numbers ; healthy adult cattle are, however, almost as suitable, being very resistant.

TREATMENT.

Anthelmintic treatment for parasitic gastro-enteritis is effective, but—as already mentioned—must be used with care in goats. The safest and best anthelmintic is phenothiazine which acts on all the pathogenic stomach and intestinal worms. Copper sulphate alone or mixed with arsenic has been a popular and widely used anthelmintic, but in either form it is only of service for the elimination of *H. contortus*.

PARASITIC BRONCHITIS ; HOOSE ; HUSK

The parasites irritate the bronchial mucosa, producing a catarrhal inflammation with a copious exudate which passes back into the bronchioles and alveoli, frequently causing atalectasis and pneumonia.

The symptoms are a severe cough, often prolonged and frequently repeated, accompanied by the discharge of a tenacious mucus from the nostrils. Dyspnœa is usually obvious ; emaciation and anæmia, accompaned by diarrhœa, are also frequently present, resulting from the parasitic gastritis which so frequently is associated with this disease.

The life history of the parasite is similar to that described for the stomach worms, except that it reaches the ground in the larval stage instead of as an egg, and the infective larvæ that subsequently develop find their way to the lung via the intestine, the lymph stream and the blood.

The general remarks on the epizootiology of parasitic gastritis also apply to parasitic bronchitis, with the exception that the parasite does not appear to be so widespread throughout the country.

Diagnosis.

This depends upon the presence of the characteristic cough, together with the confirmatory evidence afforded by finding the larvæ in the fæces, or the finding of large numbers of the adult worms in the bronchi on *post-mortem* examination.

The remarks on prevention given in the section on parasitic gastro-enteritis apply also to parasitic bronchitis except that no reliable anthelmintic treatment is known. Grazing the infected pastures with non-susceptible animals is even more practical a way of reducing the numbers of infective larvæ than it is in parasitic gastritis, since the lung worms of goats and cattle are specifically distinct and there is no danger of cross infection, even to young animals.

Treatment.

Treatment consists mainly in assisting the establishment of resistance in the diseased animals by removing them from the infected pastures and feeding them generously. Anthelmintic treatment for stomach and intestinal worms should also be carried out if there are indications of even a moderate infestation of these parasites. Parasitic gastro-enteritis is generally found to co-exist with parasitic bronchitis, on account of the similarity of the conditions under which the respective parasites increase in numbers, so that treatment for parasitic gastro-enteritis often proves of benefit.

A good state of nutrition, coupled with the cautious administration of phenothiazine (three-quarters of the dose recommended for sheep) at three-monthly intervals, are wise precautions. Intratracheal injections are not effective.

British Alpine Female

LIVER-FLUKE DISEASE ; LIVER ROT

This disease may affect goats of all ages. It appears in two forms—an acute disease (the true ' liver-rot ') caused by the mass migration of large numbers of immature flukes (*Fasciola hepatica*) through the parenchyma of the liver ; and the more common chronic form caused by the continued presence of numerous adult flukes in the bile ducts. The life-history of the parasite is intimately linked with that of the intermediate host snail, *Limnaea truncatula*, which is the only species of snail known to act as the intermediate host in Great Britain.

One or two important details in the life-history of the fluke may be recalled with advantage although, in general, the complicated cycle of changes through which the parasite passes is well known. The hatching of the eggs and consequent liberation of the miracidium may take place within nine days of leaving the host ; under suitable conditions, however, hatching may be retarded and the eggs remain viable for upwards of five months. Development in the snail takes between six and seven weeks, at the end of which time the cercariæ leave the snail and encyst on the herbage and they are then ready to begin their parasitic life in the goat ; their length of life on the pasture extends up to 12 months. On reaching the small intestine of the goat, the young flukes penetrate the bowel wall and, after a few days spent in the abdominal cavity, make their way into the liver and wander about in the parenchyma for some five or six weeks, during which time they grow to a length of 3 or 4 mm. They then enter the bile ducts and reach maturity ; eggs appear in the fæces 11—13 weeks after infection by the cercariæ.

The epizoötiology of the disease is, however, inseparably connected with the phases of the life cycle of *L. truncatula* which begins to be active in March or April, when it lays eggs that give rise to a generation of snails which produce more eggs three or four months later. Two or even three generations may occur between March and October, and, if the environmental conditions are suitable, a great increase of snails takes place. The emergence of young flukes, therefore, begins in early July and some 6 or 8 weeks later the first outbreaks of acute fascioliasis appear. On account of the three-monthly period required for the complete development of the fluke and the scarcity of cercariæ on the herbage before July, the chronic form of the disease is not seen until late in the autumn, and marked symptoms of chronic fascioliasis do not appear until the early winter months, becoming more serious and perhaps more widespread as the winter progresses.

Acute fascioliasis, on the other hand, is relatively rare in the latter part of the ' fluke season ' as in ordinary circumstances any unusual concentration of cercariæ in the herbage will have been eaten off during the late summer or early autumn, and excessively heavy infestation could only come about where infected pasture had been allowed to remain ungrazed until a late date.

The first evidence of chronic fascioliasis that may be noticed in a herd is that a few animals may be observed lagging behind the remainder and, if these animals are examined, they will be found to be markedly anæmic. Loss of condition becomes more obvious as the disease progresses and dropsical swellings may develop under the jaw and abdomen. Many of these greatly weakened animals may die during the later winter but if they survive until the spring they tend to make a gradual recovery. At *post-mortem* examination the carcase of a goat which has died of the chronic disease is found to be very emaciated, the bile ducts are greatly enlarged and thickened and may be found to contain numbers of adult flukes.

The acute form of the disease, however, may appear in animals in fat condition and death may supervene after only a few days' illness. The affected animals stand apart, show a marked disinclination to move and the abdomen often may be found to be distended and painful to the touch. At *post-mortem* examination, a blood-stained fluid may be found in the abdominal cavity and the liver may be enlarged, hæmorrhagic, and friable. If the cut surface is squeezed in water, and the sediment carefully washed by decanting and re-sedimenting two or three times, a number of immature flukes, up to $\frac{1}{4}$ inch in length, may be recovered.

Diagnosis.

Diagnosis of the chronic form of the disease depends upon the observation of the symptoms already described, and the demonstration of eggs in the fæces. The diagnosis of the acute disease is, however, less simple, and an isolated outbreak often is determined with certainty only at *post-mortem* examination, fæcal examination being of no assistance.

With reference to the identification of the eggs in the diagnosis of the chronic disease, it is best to rely upon the large-size and bright, yellowish-green contents which completely fill the shell, rather than upon the lid or operculum which is present at one end of the egg and is not a good feature for recognition, being difficult to see until the egg is almost ready to hatch. The ordinary flotation technique cannot be

employed in searching for these eggs since they do not rise to the surface in the heavy salt or sugar solutions usually employed. They are best found by the use of the dilution technique, 300 to 600 eggs per gramme being a rough indication of the presence of a pathogenic infestation. Since, however, the development of the fluke is so slow, the infestation is frequently heavier than the egg count indicates so that the finding of any fluke eggs in the fæces during the later summer, autumn, or winter is indicative of the need for treatment.

Caution must be observed in accepting as diagnostic evidence the finding of what may appear to be the intermediate host snail *L. truncatula*, since immature specimens of other common members of the genus *Limnaea* can be distinguished only on expert examination.

Treatment.

Carbon tetrachloride may be used or, as an alternative, hexachloroethane. *Both these drugs are used at the same risk as in sheep where the animals are on a high plane of nutrition.* The latter drug should be given at a dosage of 25-35 gm. as a drench three to four hours before food ; a second dose should be given after three weeks.

The rumen fluke, *Paramphistomum cervi*, may occur and cause enteritis, due to the migration of immature flukes. Measures should be aimed at controlling the snail population.

COCCIDIOSIS

The full investigation of diseases of goats caused by coccidia still awaits the attention of the protozoologists. Although it is generally assumed that the species harboured by goats are the same as those of sheep this assumption still requires experimental proof. The undoubted similarity of the disease, however, to the better known coccidiosis of other species of farm animals gives a clear indication of the best approach to control.

Life History of the Parasite.

Infection is brought about by the ingestion along with food or water, of the sporulated oocyst, *i.e.*, a fertilised cyst that has been outside the body of the carrier animal for a sufficiently long time for sporulation to be completed. This may vary from one to ten or twelve days or more depending upon the species of the parasite and the temperature of the environment. Eight sporozoites, derived from the four spores within the sporulated oocysts, are released into the intestine and penetrate the cells lining the wall where they grow into schizonts which later give rise to merozoites. These

merozoites are liberated into the lumen of the intestine by the rupture of the host cell. Once the merozoites are in the intestinal lumen they quickly penetrate other epithelial cells and the asexual cycle of development (schizogony) is repeated. The repetition is, however, of limited duration and the schizogonous phase ultimately gives rise to the sexual or sporogenous phase in which the merozoites become differentiated into male and female elements. Oocysts, the product of the fusion of these elements, are released by the rupture of the invaded cells and eventually are voided with the fæces. A certain period, the length of which depends on environmental factors such as temperature, aeration and moisture, must be passed in the outside world before the oocysts mature, *i.e.*, attain to the fully sporulated condition and become infective to new hosts.

Of the several species of *Eimeria* that occur in goats the most intensive observations have been made on *E. arloingi* which is capable of producing severe disease, particularly in lambs and in goatlings. At times it has been known to occur in a most virulent form leading to the death of a large percentage of the herd. Three types of infestation have been noticed: (1) Latent coccidial infestation with little or no abnormality, occurring in animals of all ages ; (2) chronic coccidiosis in goatlings more than two months old, passing unnoticed in the early stages, but later leading to cachexia and death; and (3) acute coccidiosis, characterised by extreme constipation, the fæces being coated with grey, yellow or brown mucus, sometimes streaked with blood. This form of the disease occurs in goatlings four to eight weeks old and frequently leads to death.

Epidemiology.

Coccidial infestation in goats is very widely distributed so that the latent infection mentioned above may be regarded as normal, the pathogenic action of the parasites resulting only from massive infestation. This may occur either on crowded paddocks or more frequently under unhygienic conditions of housing. Oocysts may be passed in the fæces in such small numbers that ordinary microscopical examination fails to detect their presence ; they are frequently found, however, in appreciable numbers even in the fæces of healthy goats. Adult animals are resistant to the disease " coccidiosis," although they very often harbour the parasite and act as carriers from which the susceptible immature animals become infected. Because of the self-limiting nature of the life cycle resulting from the definite time limit for the vegetative phase of development, which has been described in the account already

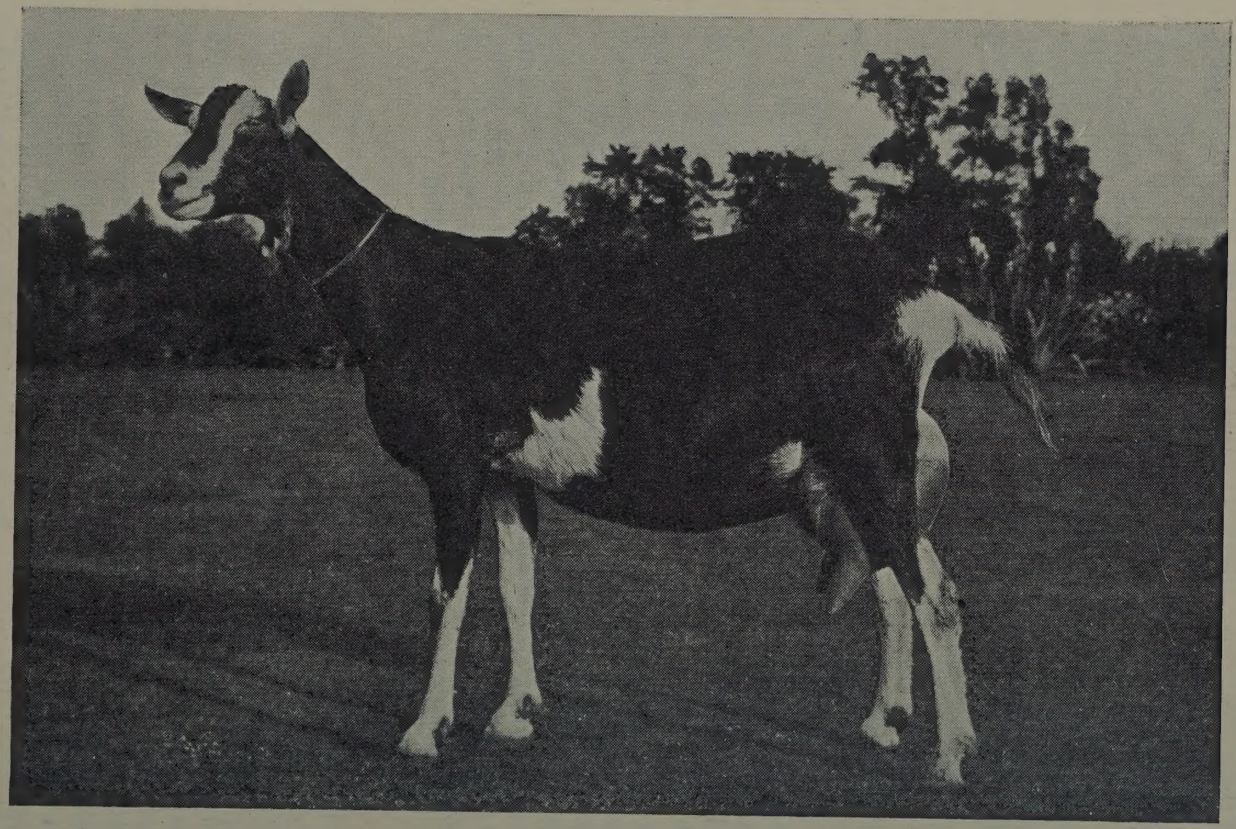
given, mere infection with small numbers is not sufficient to bring about disease. This can only result either from a massive invasion at one time, such as is likely to occur under natural conditions, or from the repeated intake of small numbers. The circumstances under which the disease most frequently occurs are those of young goats crowded together, and the onset of symptoms is often sudden in these circumstances although the building-up of infection may have been gradual. Infections become less severe as the epidemic progresses, a result, in all probability, of the development of immunity in the group of affected animals. A certain number of debilitated animals, in which recovery is never quite complete, is usually left after an outbreak.

Diagnosis.

Diagnosis of the disease is made from the symptoms, the history of the outbreak, and the presence of oocysts in the fæces. Counts of the oocysts can be carried out in a manner similar to that used for worm eggs, or they may be concentrated by the salt flotation method, but no reliance can be placed on oocyst counts as a diagnostic procedure. Comparisons between oocyst counts in the fæces of suspected cases and seemingly normal animals of the same herd may sometimes be instructive. The output of oocysts varies greatly during the course of the disease, the numbers during the most acute phase sometimes being relatively small, owing to a large proportion of the parasites not having reached the sexual cycle which terminates in oocyst production.

Control.

Two points should be borne in mind when control measures are being contemplated : (1) Carriers of coccidia are common; and (2) the excessive ingestion of oocysts is particularly harmful to young stock. Young goatlings should never be introduced into crowded quarters occupied by a group of goatlings of various ages. As most goats carry coccidia, quarters which have been occupied by the original group for some time will carry a substantial number of infective oocysts available for re-infection, so that large numbers of oocysts ultimately are being discharged. Goatlings subsequently introduced are then—when they are in their most susceptible state—suddenly exposed to large numbers of infective oocysts, and acute disease results.



English Female

TREATMENT.

Sulphamezathine, in the form of a suspended powder given as a draught, or as powder enclosed in a capsule, is the recommended treatment and is given as a first dose of 0.2 gm./kilo body weight (about $\frac{1}{3}$ oz. per 100 lb. body weight), followed by half the initial dose, divided into two, and given night and morning.

As with the forms of coccidiosis in other kinds of farm animals and birds, the facilities offered by the environment for continuous reinfestation are of great importance in the development of the disease, and crowded conditions in the field, and unhygienic housing conditions, are to be avoided.

DISINFECTION.

The disinfection of premises is best carried out with a 10 per cent. watery solution of ammonia which has been found to have a particularly marked lethal effect upon the oocysts. Manure from diseased animals should be mixed with horse manure to encourage fermentation, with the resulting production of ammonia and other toxic products of decompositon which are destructive to oocysts. The manure should not be used on goat pastures.

OTHER INTERNAL PARASITES

Strongyloides papillosus.

These may be present in the small intestine of goats. Ill-effects are probably few, though the penetration of the larvæ through the skin may aid in setting up foot rot. Control is by provision of clean, dry quarters and dry runs. Effective treatment is difficult, phenothiazine being completely ineffective.

Chabertia ovina.

This worm infests the colon of goats. Heavy infestations may occur and cause death, but recognition of the disease would probably not be made until *post-mortem* examination. Phenothiazine is very effective in removing this worm.

DISEASES CAUSED BY EXTERNAL PARASITES

LICE

British goats are affected by two species of biting lice—*Bovicola caprae* and *B. limbatus*, and by one species of sucking louse—*Linognathus stenopsis*. Infestation can occur at all ages but kids are the most susceptible, heavy infestation of adult animals being restricted to those in a weak and unthrifty condition. A dry, scurfy condition of the skin is characteristic of infestation and the constant rubbing leads to breaking of the hairs and to an unhealthy appearance of the coat.

The eggs, which are attached to the hairs, give rise to young lice in one or two weeks' time, the adult stage being reached after a further three to five weeks, and the life cycle may be completed within four to ten weeks. Although it is normal for lice to spend their whole life on the goat, under the most favourable conditions they are able to survive off the host for as long as 18 days, so that clean animals may become infected through indirect contact with infested ones. In common with the lice of other kinds of farm animals the degree of infestation tends to fall during the summer and to increase rapidly during the autumn and winter.

Control.

Sucking lice are more difficult to kill than are the biting lice. Arsenic dips and derris dusts, which were only of relative value, have now been superseded by D.D.T. and Gammexane, by which complete control is easily obtained. An emulsion containing some 0.2 per cent. or a dust containing 3 per cent. of D.D.T. is very effective, and suspensions or emulsions of Gammexane as dilute as one part in 10,000 have given complete control. Sufficient residue remains in the coat to render it toxic to lice for as long as sixteen days, so that one treatment alone is usually sufficient. The proper procedure is to include every member of the herd when treatment is instituted and, preferably, to turn them into a clean run, although the length of protection given by the new insecticides largely dispenses with this requirement.

SHEEP NOSTRIL FLY

Although rarely a cause of trouble, the sheep nostril fly (*Oestrus ovis*) may occur in goats in Great Britain. The fly lays its larvæ in the nostrils. These first instar larvæ feed on the mucosa of the nasal passages. They then migrate

to the region of the ethmoid and turbinate bones, moult, and migrate as second instars to the frontal sinuses where they continue their development and moult to the third instar. The fully grown third instar makes its way to the nasal passages and drops out or is sneezed out. It pupates in the ground and the adult fly emerges after a period of three weeks to two months, depending on the season.

During the early phase of infestation, and also when the fully fed larvæ are migrating outwards, they may cause considerable irritation and give rise to a nasal discharge which is sometimes purulent. In the majority of cases, however, the infestation consists of only a few parasites, no symptoms being shown. Very rarely larvæ penetrate to the brain and may cause symptoms of meningitis and encephalitis.

The larva in the head may complete its development in as short a period as 25 days during warm weather, but on the other hand, it may take 11 months. This variation is due to the fact that of the first instars deposited in the nostrils, some develop rapidly and migrate, while others remain as minute first instars in the nasal passages for months. Once the second instars reach the frontal sinuses, their development proceeds at a uniform rate. Expulsion of fully grown larva is thus spread over the summer period, even though only one infestation occurs. In cold weather, development in the nasal passages is suspended and the larvæ there may remain as first instars for up to nine months. Infestation occurs during the warm days of summer.

SHEEP KED.

This is rare in goats. The ked (*Melophagus ovinus*). is a blood-sucking wingless fly which spends its whole life on the sheep or goat and cannot survive on any other host. The female ked lays a fully developed larva enclosed in a sticky membrane which adheres to the hairs and which in a few hours hardens and darkens to form the pupa case. On an average the pupa develops in nineteen to twenty-four days (limits eighteen to thirty) and the female, if fertilised, produces her first pupa about fifteen days after emergence. She then continues to lay at approximately seven-day intervals, about ten eggs being produced in her lifetime.

When off the sheep or goat, the ked, unless under exceptional conditions of cool temperature and high humidity—when it may live for up to twenty-four days—can survive for only a few days, usually less than a week. Pupæ will not develop at ordinary air temperatures, and are killed by prolonged exposure to quite moderate low temperatures, *e.g.*, 4°C.

Ked populations are at their maximum in the spring. In early spring, the adult keds are found over most of the body, but are most numerous on the chest, lower shoulders, ribs, flanks and hindquarters. Pupæ are found on the throat and chest and along the lower border of the ribs, flanks and hindquarters. As the weather gets warmer the adults are driven to the lower aspects of the rib, shoulders and hindquarters and to the chest and abdomen. Pupæ are similarly restricted.

In heavy infestations, there is biting and rubbing. Control can be effected by single application of a derris wash, containing 0.01—0.02 per cent. rotenone. D.D.T. is also very effective, 3 lbs., 20 per cent. D.D.T. per 100 gallons, being used. Gammexane in a concentration of 1 : 25,000 gives protection for three weeks.

TICKS

Three species of ticks can infect goats—*Ixodes ricinus* is the likeliest to be met with. *Hæmaphysalis punctata* also occurs in goats and has been reported in Kent. *Dermacentor reticulata* may affect goats in Devon, Somerset and Wales, but is rare in other parts of Britain.

Both the important species are three-host ticks and the larvæ, nymphs and adults all infest sheep and goats. The larvæ of *I. ricinus* feeds for three to five days, the nymph for four to six days, and the adult female for seven to eleven days. The male does not feed to any extent. Metamorphosis occurs on the ground, the duration depending on the season. The life-cycle extends over a period varying from one and a half years to over four years according to the availability of hosts. The life-history of *H. punctata* is very similar.

Ticks infest animals from early March until June, the peak incidence being in April or early May. Infestations are usually slight or absent during the latter part of the summer, but a recrudescence of the infestation occurs in September; on high or cold ground, however, the infestation level may remain high through the summer. In winter, infestation is practically absent. The sheep tick—*I. ricinus*—occurs in very large numbers on the rough pastures of the Scottish Highlands, the Border uplands and Pennine range, North Wales, Cornwall and Devon.

Unfed ticks awaiting a host, and gorged stages undergoing development among the grass roots, require a very high moisture content in their immediate environment to enable them to survive and their dependence on moisture is greater in warm weather when their rate of metabolism is higher. Favourable, moist conditions are found only in summer in the microclimate of moss and rough vegetation over peat or acid

soils. The tick is thus restricted in its distribution by its summer requirements, and although continuously broadcast on to arable ground or good pasture from adjoining rough grazings, it fails to establish itself and serious infestations do not occur among the stock in such areas.

Ticks infest goats principally around the neck and ears and in the axillæ ; nymphs concentrate more on the ears and face, often forming a bead-like fringe to the ears and studding the mouth, like black dew-drops ; larvæ occur round the lips, and under the chin, and on the lower legs where they are less readily detected. A typical infestation for the hill country of Scotland and northern England is from 10—100 or so females and from two to three times as many nymphs.

Control of the tick may in certain cases be achieved by improving pasture conditions so as to eliminate the moss ; but because of the ability of the tick to maintain itself on hosts other than sheep, the starvation of the tick population by removal of sheep and goats from an area is not possible. The immature stages feed readily on birds and the female on such mammalia as deer, foxes, hares and hedgehogs.

On moors and hill pastures eradication of the tick by any means is seldom practicable, and the best control measures consist in the protection of goats with parasiticides.

For treatment of infested animals prior to removing them to clean ground, a quick-killing dip—such as derris—is satisfactory.

MANGE MITES

Goats are susceptible to infestations of *Sarcoptes scabiei*, and *Psoroptes communis capræ. Chorioptes bovis capræ and Demodex capræ* have also been recorded as affecting goats, but not in Great Britian, although it is not improbable that they do occur.

Sarcoptic Mange.

This is the only serious form of mange that is likely to occur in goats in Great Britain. It is spread by direct contact and rarely through the medium of sheds or utensils, the parasites being unable to survive away from the host for more than three weeks, and losing their power to infest a new host after a fortnight. This knowledge shows that premises need only be left vacant for three weeks for all danger of transmission of sarcopts to have disappeared, and that there is no need to carry out disinfecting procedures.

Goats of all ages may be affected. Commonly the disease begins on the head and spreads to other parts which are covered with short hair ; the limbs, especially around the

An English Female

joints ; the groin and perineum ; later the belly, breast and flanks. Violent irritation is caused and incrustations are produced ; these scabs are sometimes very thick in the region of the joints. The skin becomes greatly thickened and cracks are produced which become infected. Unless treated the animals may succumb to the disease rapidly, although the approach of summer often brings recovery. This, however, may only be apparent and a recrudescence occur on the approach of winter.

The female mite burrows into the skin to lay a total of some forty or fifty eggs. On hatching these grow quickly to maturity, the whole life cycle occupying ten to fourteen days at the minimum, and, on the average, fourteen to twenty-one days. Eggs can retain their viability off the host for about one week. Only the ovigerous female burrows into the skin, the larvæ, nymphs, males and young females all remaining under the crusts on the surface of the skin.

The duration of the various stages in the life history of the mite is shown in the following table :—

Life History of *Sarcoptes scabiei.*

Females.		*Males.*	
Egg stage	= 2½—3½ days.	Egg stage	= 2½—3½ days.
Larval stage	= 1½—3 „	Larval stage	= 1½—3 „
First nymphal stage	= 1½—2½ „	Nymphal stage	= 1½—2½ „
Second nymphal stage	= 2 —4 „	Adult male	
Adult female			

Sarcoptes scabiei from other farm animals is capable of causing mange in goats. Likewise *S. scabiei* from goats may cause mange in other animals but cross infestations contracted in this way are less severe and usually of very temporary duration.

PSOROPTIC MANGE.

In the goat this form of mange (due to *Psoroptes communis caprae*) is localised in the ears. An irritation of the skin results with accompanying exudation and coagulation of serum on the surface. This form of mange usually causes little harm, although the incrustation may be so extensive as to result in partial deafness.

This parasite is incapable of causing disease in the sheep.

Control. Gammexane emulsions or suspensions are the best means of treatment, a strength of one part in 5,000 being adequate. Local dressing of the ears alone is sufficient for the control of *Psoroptes*, but for *Sarcoptes* it is necessary to dip all of the members of the herd.

CHORIOPTIC MANGE.

This may occur in goats but is comparatively rare.

DEMODECTIC MANGE—due to infection with *D. capræ*.

The parasite is a similar one to the canine variety and, while little is known about the life cycle, it is certain that the parasites live away from the body for several days, and can survive up to twenty-one days in moist skin. Irritation is not a marked feature, and the disease usually takes the pustular form. Pustules may be up to about one inch in diameter, and secondary infection frequently occurs.

Control. Good food, light and exercise are very beneficial in aiding treatment. Autogenous vaccines against secondary invaders, particularly staphylococci, have been used.

HARVEST MITE

The adult mites of this species (*Trombicula autumnalis*) are free-living, and prey on other small arthropods; it is only the larvæ that are parasitic on animals and on man. Goats usually become infested on the head and neck where an intense pruritus and even dermatitis may result. This sometimes continues for several days and results in a loss of hair from the affected regions.

Although it is not improbable that Gammexane preparations would afford some protection, as yet there is little known of its efficacy and efforts should be made during the late summer and autumn to keep goats away from regions that are known to be heavily infested.

TOXICOLOGY

The general susceptibility of goats to all classes of poisonous substances is similar to that of other species of ruminants and like these other species the goat possesses idiosyncrasies to certain poisons. Perhaps the most important of these idiosyncrasies is that for sulphanilamide and possibly for other members of the sulphonamide group of drugs. So marked is the susceptibility for sulphanilamide that death may result from an initial dose of ½ to 1 ounce which is regarded as a safe normal dose for most goats. What may perhaps be regarded as an unusual form of idiosyncrasy is the red pigmentation of the skin that is so obvious in a white goat some two or three days after it has been dosed with phenothiazine. This pigmentation is harmful only because of its unsightliness but it may persist for some weeks.

The ability of goats to reach up to quite considerable heights and their habit of nibbling at accessible trees, shrubs and plants render them possible subjects for plant poisoning.

It is, however, found that though goats may be able to reach poisonous plants and though there may be evidence that some of the plant has been cropped, no signs of poisoning appear. This apparently contradictory state of affairs is probably explained by the goat normally only nibbling at such plants. Before poisoning can result the goat must consume an excessive quantity of the plant, for in most poisonous plants the toxic principle is present only in small amounts. It may well be that factors in producing many cases of plant poisoning in the goat are hunger and the inavailability of other food.

The practice of tethering goats cuts out the risk of plant poisoning if the goats are tethered on ground free from and out of reach of poisonous plants. On the other hand, if a goat is tethered in proximity to poisonous plants the very act of tethering increases the risk of poisoning especially if there is not sufficient other food available.

Chemical Poisons.

Goats like other animals may ingest poisons that are left lying around with that all too common measure of careless disregard for the consequences. They may also suffer from the effects of eating poisons that have been laid down deliberately with the purpose of destroying pests, particularly rats. Less commonly goats may be poisoned when weed killers have been used on ground to which they have access.

Under the heading of chemical poisons falling into this category are a large group of metallic, inorganic and organic compounds. In general their toxic actions in the goat do not differ materially from those of other species. It is therefore unnecessary to recapitulate the toxic actions and their signs since these are to be found in any standard text-book on veterinary pharmacology and toxicology.

The poisons most likely to be encountered as causing trouble in goats are arsenic and arsenic compounds, strychnine, phenols, and phosphorus compounds, especially zinc phosphide.

Except in the case of strychnine in which the muscular spasms are fairly characteristic, poisoning does not give rise to a group of symptoms that is sufficiently characteristic to enable a definite diagnosis to be formed. Sometimes the circumstantial evidence is strongly suggestive of poisoning, and further investigation renders corroboration possible. Unfortunately the circumstantial evidence all too often is found to be confusing. The only satisfactory proof that poisoning has taken place is either a complete sequence of events linking the present illness with a proven poison or a positive chemical analysis of alimentary contents and those tissues in which the poison has been deposited.

Treatment of chemical poisoning is largely symptomatic and is directed to dealing with those actions manifested by the clinical signs. If it is known or suspected that a particular poison is responsible and if there is a specific antidote for that poison then it should be administered.

Plant Poisoning.

Occasionally it may happen that a goat has access to one poisonous plant and to that plant alone, but very often suspicions of plant poisoning in a goat are aroused when the sick animal has had access to a shrubbery containing a diversity of plants, many of them potentially poisonous. This diversity complicates diagnosis and differential diagnosis. Furthermore, there is always a risk that in inexplicable cases of illness in grazing animals a diagnosis of plant poisoning may be formulated on rather slender evidence. It can safely be stated as a general rule that before poisoning with plants can take place a substantial quantity of the plant must have been eaten.

The plants causing poisoning may be divided conveniently into two groups (1) trees and shrubs, and (2) herbaceous plants. Many of these are cultivated species deliberately planted, some thrown out by gardeners may have established themselves, and some are wild plants growing naturally in the district. Wild herbaceous plants are found principally in the south and south-west of England; they are much less common in the north of England and Scotland. The following lists indicate the range of the plants more commonly regarded as being poisonous to stock:

1. Trees and Shrubs.

   Yew (*Taxus baccata*), Rhododendron (Rhododendron spp.), Cherry Laurel (*Prunus laurocerasus*) and other species of laurel, Spindle Tree (*Euonymus europœus*), Buckthorn (*Rhamnus catharticus*), Daphne, various species (*Daphne* spp.). It is very doubtful if Laburnum (*Cystisus laburnum*) ever caused poisoning in a goat since these animals pointedly avoid laburnum.

2. Herbaceous Plants.

   Monkshood (*Aconitum napellus*), Autumn Crocus or Meadow Saffron (*Colchicum autumnale*), Spurge (*Euphorbia* spp.), Cuckoo Pint or Lords and Ladies (*Arum maculatum*), Hellebores (*Helleborus* spp.), Brassica (*Brassica* spp.), Hemlock (*Conium maculatum*), Water Dropwort (*Oenanthe crocata*) and Cowbane (*Cicuta virosa*).

The active poisonous principle in these plants varies in composition ; it may be an alkaloid, a glucoside, a volatile oil or a cyanogenetic glucoside.

There are very few poisonous plants that give rise to sufficiently characteristic clinical signs to permit the probable nature of the poisoning being identified by a consideration of these signs. In the great majority of instances of plant poisoning the animal's illness is manifested by salivation, diarrhœa, abdominal discomfort and possibly straining. Evidence that a plant has been eaten and the knowledge that it has the action of an alimentary irritant enables the clinician to form a tentative diagnosis.

The two principal exceptions to this general rule are Yew and those plants that liberate prussic acid, namely, various species of laurel such as Cherry Laurel and Portuguese Laurel.

The characteristic feature of yew tree poisoning is its suddenness. When an animal has eaten sufficient yew to cause poisoning it may drop down dead so suddenly that it appears to have been felled in its tracks. It must be remembered that many animals, including goats, nibble at yew trees with impunity. When a substantial quantity of yew, insufficient to cause death, has been eaten, the animal appears dull and stupid. These symptoms pass off if the animal is given a bland purge and stimulants.

The characteristic feature of poisoning with those plants containing a cyanogenetic glucoside is the respiratory stimulus resulting from the absorption of prussic acid elaborated by the plant tissues. The chemical antidote is freshly precipitated moist ferric hydroxide. Sodium thiosulphate in solution may be given intravenously.

In the case of the other trees, shrubs and plants the essential feature of their toxicology is gastro-intestinal irritation. Symptomatic treatment then consists of simple laxatives, bland demulcent fluids and anodynes.

In any case of suspected poisoning it is obviously desirable that the affected animal, and any others with it, should be removed to a place where they can no longer have access to the suspected source of poisoning. Steps can then be taken to eliminate the risk by fencing the area, cleaning up the affected region, pruning the plants or even digging them up in their entirety.

There are many plants that are suspected of being poisonous to stock ; in some cases these suspicions are based on very slender evidence ; in other cases there are no grounds for believing that the plant has ever caused poisoning. As far as goats are concerned there may be included under this category such plants as Box, Tansy, Privet and Ragwort.

Though acorns are used as a food for livestock they have been known to cause illness. Whatever the exact mechanism may be, illness is associated with an accumulation of acorns in the rumen, and therefore appears to be a consequence of excessive consumption. Rumenotomy to permit the removal of the acorns may if carried out promptly save the animal's life.

For further details of toxicology the reader is referred to Lander's Toxicology (3rd Edition revised by Nicholson), published by Baillière, Tindall and Cox, London.

ANÆSTHESIA.

Goats are not good subjects for ether or chloroform anæsthesia. Nembutal may be used. There appear, however, to be wide variations in the susceptibility to the drug among goats. While the approximate dose is 1 grain per 8 lbs., it is essential to inject the drug very slowly, stopping when the required depth of narcosis is reached. Cyclopropane-oxygen anæsthesia is excellent for goats if the necessary simple equipment is at hand. With this method there is a high margin of safety, the depth of anæsthesia is readily controlled, and recovery is very rapid with no post-operative complications. Chloral intravenously has been used with success. Administration must be very slow. There are also good reports on the use of pentothal sodium intravenously, again administered very slowly, and preceded by an injection of atropine to control the profuse salivation which may occur in some cases.

Printed in Great Britain by Hudson & Son Ltd., Birmingham 3.